USB-4761

8-channel Relay, 8-channel IDI USB Module

User Manual

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This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

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CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advantech.com

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

1. To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
2. Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

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CHAPTER 1

Introduction

This chapter will provide information on the features of the DAS module, a quick start guide for installation, and some brief information on software and accessories for the USB-4761 Module.

Sections include:

- Features
- Applications
- Installation Guide
- Software Overview
- Device Driver Programming

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Chapter 1 Introduction

Thank you for buying the Advantech's USB-4761 data acquisition module. The Advantech USB-4761 is a powerful data acquisition (DAS) module for the USB port. It features a unique circuit design and complete functions for data acquisition and control.

1.1 Features

USB-4761 has the most requested measurement & control functions:

- 8 relay output (Form C) and 8 isolated digital input channels
- LED indicators to show activated relays
- High-voltage isolation on input channels (2,500 VDC)
- High ESD protection (2,000 VDC)
- Wide input range (5 ~ 30 VDC)
- Interrupt handling capability
- Supports USB 2.0
- Bus-powered
- Wiring terminal on Modules

Note: *You can install up to sixteen USB-4761's to a system because of the restriction of device BoardID*

Note: *The power output of an USB port is 500 mA, while the USB-4761 requires 400mA (Max.). This means that if an USB hub is used, it will need an external power supply to support more than one USB-4761 device.*

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1.1.1 Robust Protection

The USB-4761 digital input channels feature a robust isolation protection for industrial, lab and machinery automation applications. It durably withstands voltage up to 2,500 VDC, preventing your host system from any incidental harms. If connected to an external input source with surge protection, the USB-4761 can offer up to a maximum of 2,000 VDC ESD (Electrostatic Discharge) protection.

1.1.2 Wide Input Range

The USB-4761 has a wide range of input voltage from 5 to 30 V_{DC}, and it is suitable for most industrial applications with 12 and 24 V_{DC} input voltage.

1.1.3 Reset Protection for Industrial Applications

When the system has undergone a hot reset (i.e. without turning off the system power), USB-4761 can either retain outputs values of each channel, or return to its default configuration as open status, depending on its onboard jumper setting. This function protects the system from wrong operations during unexpected system resets.

1.1.4 Plug & Play Function

USB-4761 is a portable Plug-&-Play device that fully complies with the USB 2.0 specification. During module installation, all bus-related configurations such as base I/O address and interrupts are conveniently taken care of by the Plug-&-Play function. You have virtually no need to set any jumpers or DIP switches.

Note: For detailed specifications of USB-4761, please refer to Appendix A, Specifications.

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1.2 Applications

- Industrial On/Off control
- Switch status sensing
- Digital I/O control
- Industrial and lab automation
- SMT/PCB machinery
- Semi-conductor machinery
- PC-based Industrial Machinery
- Testing & Measurement
- Laboratory & Education
- External relay driving

1.3 Installation Guide

Before you install your USB-4761 module, please make sure you have the following necessary components:

- USB-4761 DAS Module
- USB-4761 User Manual
- Shielded USB 2.0 cable (1.8 m)
- Driver software Advantech DLL drivers (included in the companion CD-ROM)
- Personal computer or workstation with a USB port (running Windows 2000, or XP)

Some application software is also available for enhanced operation. USB-4761 works with ActiveDAQ, ActiveDAQ Pro, and other third-party software packages.

After you have the necessary components and maybe some accessories for enhanced operation of your USB DAS module, you can then begin the installation procedure. Figure 1.1 on the next page provides a concise flow chart to give a broad picture of the software and hardware installation procedures.

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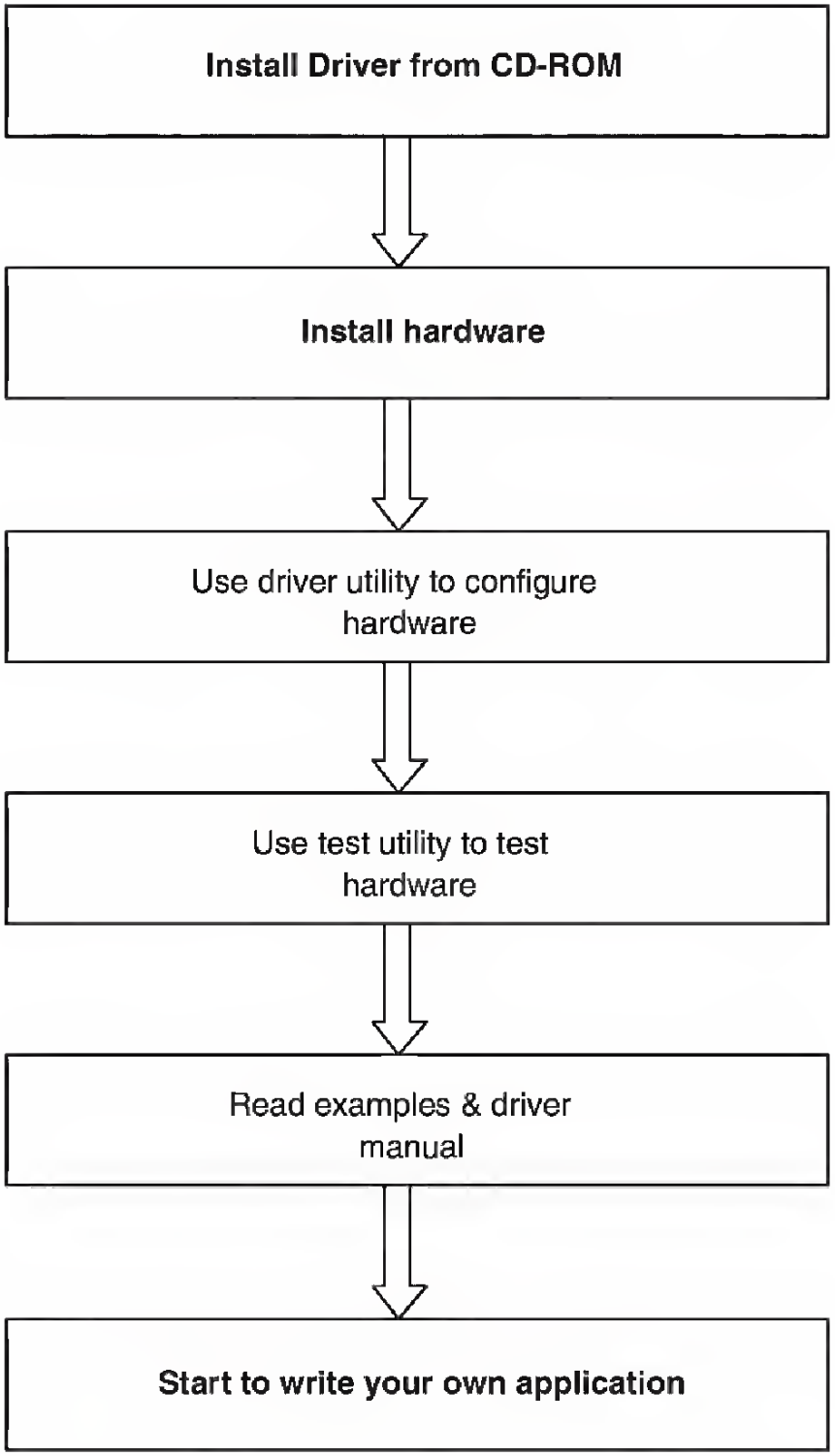
Install Driver from CD-ROM
Install hardware
Use driver utility to configure hardware
Use test utility to test hardware
Read examples & driver manual
Start to write your own application

Figure 1.1: Installation Flow Chart

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1.4 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver support and application software to help fully exploit the functions of your USB-4761 module:

- Device Drivers (on the companion CD-ROM)
- LabVIEW driver
- Advantech ActiveDAQ
- Advantech ActiveDAQ Pro

1.4.1 Programming Choices for DA&C Module:

You may use Advantech application software like Advantech Device Drivers. On the other hand, advanced users are allowed to use register-level programming as another option, although this is not recommended due to its laborious and time-consuming nature.

1.4.2 Device Drivers

The Advantech Device Drivers software is included on the companion CD-ROM. Advantech's Device Drivers features a complete I/O function library to help boost your application performance. The Advantech Device Drivers for Windows 2000/XP works seamlessly with development tools such as Visual C++, Visual Basic, Inprise C++ Builder, and Inprise Delphi.

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1.5 Device Driver Programming

This section will provide a roadmap to demonstrate how to build an application from scratch using Advantech Device Drivers with your favorite development tools such as Visual C++, Visual Basic, Delphi, or C++ Builder. The step-by-step instructions on how to build your own applications using each development tool will be given in the Device Drivers Manual. Moreover, a rich set of example source code is also given for your reference.

1.5.1 Programming Tools

Programmers can develop application programs with the following development tools:

- Visual C++
- Visual Basic
- Delphi
- C++ Builder

For instructions on how to begin programming in each development tool, Advantech offers a Tutorial Chapter in the Device Drivers Manual for your reference. Please refer to the corresponding sections in this chapter on the Device Drivers Manual to begin your programming efforts. You can also look at the example source code provided for each programming tool, since they can get you very well oriented.

The Device Drivers Manual can be found on the companion CD-ROM. Alternatively, if you have already installed the Device Drivers on your system, The Device Drivers Manual can be readily accessed through the Start button:

Start/Programs/Advantech Automation/Advantech Device Manager /Device Driver's Manual

The example source code can be found under the corresponding installation folder such as the default installation path:

\Program Files\Advantech\ADSAPI\Examples

For information about using other function groups or other development tools, please refer to *Creating Windows 2000/XP Applications with Device Drivers* chapter and the *Function Overview* chapter in the Device Drivers Manual.

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1.5.2 Programming with Device Drivers Function Library

Advantech Device Drivers offer a rich function library that can be utilized in various application programs. This function library consists of numerous APIs that support many development tools, such as Visual C++, Visual Basic, Delphi and C++ Builder.

1.5.3 Troubleshooting Device Drivers Error

Driver functions will return a status code when they are called to perform a certain task for the application. When a function returns a code that is not zero, it means the function has failed to perform its designated function. To troubleshoot the Device Drivers error, you can pass the error code to DRV_GetErrorMessage function to return the error message. Alternatively, you can refer to the Device Drivers Error Codes Appendix in the Device Drivers Manual for a detailed listing of Error Codes, Error IDs and the Error Messages.

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CHAPTER 2

Installation

This chapter has a package item checklist, proper instructions about unpacking and step-by-step procedures for both driver and USB installation..

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Device Setup & Configuration
- Device Testing
- Hardware Uninstallation

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Chapter 2 Installation

2.1 Unpacking

After receiving your USB-4761 package, please inspect its contents first. The package should contain the following items:

- USB-4761 Module
- Shielded USB 2.0 Cable (1.8 m)
- Companion CD-ROM (DLL driver included)
- User Manual

The USB-4761 Module harbors certain electronic components vulnerable to *electrostatic discharge* (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to. ***Before removing the module from the antistatic plastic bag, you should take following precautions to ward off possible ESD damage:***

- Touch the metal part of your computer chassis with your hand to discharge static electricity accumulated on your body. One can also use a grounding strap.
- Make contact between the antistatic bag and ground before opening the bag.

After taking out the module, you should first:

Inspect the module for any possible signs of external damage (loose or damaged components, etc.). If the module is visibly damaged, please notify our service department or our local sales representative immediately. Avoid using a damaged module with your system.

- Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.

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2.2 Driver Installation

We recommend you install the software driver before you install the USB-4761 module into your system, since this will guarantee a smooth installation process.

The 32-bit DLL driver Setup program for the USB-4761 module is included on the companion CD-ROM that is shipped with your module package. Please follow the steps below to install the driver software:

Step 1: Insert the companion CD-ROM into your CD-ROM drive.

Step 2: The Setup program will be launched automatically if you have the auto-play function enabled on your system. When the Setup Program is launched, you'll see the following Setup Screen.

Note: If the auto-play function is not enabled on your computer, use Windows Explorer or Windows Run command to execute Setup.exe on the companion CD-ROM.

Figure 2.1: Advantech Automation Software Setup

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Step3: Click *Continue*, and select the *Installation* option

Step4: Select the specific device and then just follow the installation instructions step by step to complete your device driver installation and setup.

For further information on driver-related issues, an online version of the Device Drivers Manual is available by accessing the following path:

Start\Programs\Advantech Automation

\Advantech Device Manager\Device Driver's Manual

2.3 Hardware Installation

Note: Make sure you have installed the software driver before you install the module (please refer to Section 2.2 Driver Installation)

After the DLL driver installation is completed, you can now go on to install the USB-4761 module in any USB port that supports the USB 2.0 standard, on your computer. It is suggested that you refer to the computer's user manual or related documentation if you have any doubts. Please follow the steps below to install the module on your system.

Step 1: Touch the metal part on the surface of your computer to neutralize the static electricity that might be in your body.

Step 2: Plug your USB module into the selected USB port. Hold the module only by its edges Plug the module firmly into place. Use of excessive force must be avoided; otherwise the module might get damaged.

Note: In case you installed the module without installing the DLL driver first, Windows 2000/XP will recognize your module as an "unknown device" after reboot, and will prompt you to provide necessary driver. You should ignore the prompting messages (just click the Cancel button) and set up the driver according to the steps described in Section 2.2 Driver Installation.

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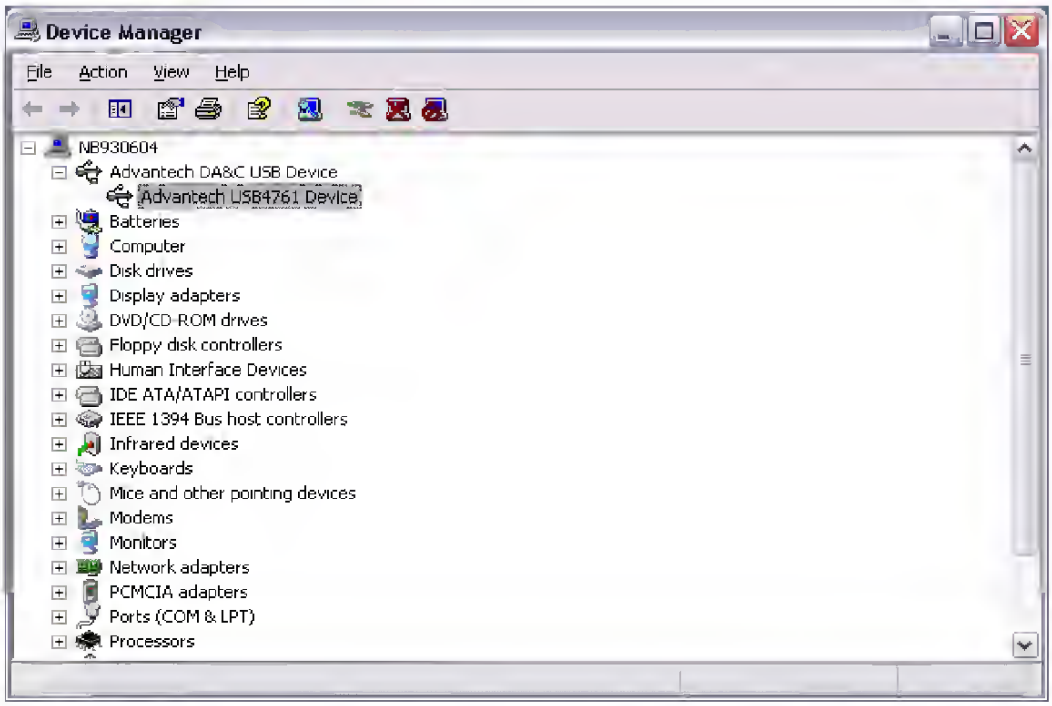

Figure 2.2: Device Name on the Device Manager

Note: *If your module is properly installed, you should see the device name of your module listed on the Device Manager tab. If you see your device name listed, but marked with an exclamation sign "!" (Fig. 2-4), it means your module has not been correctly installed. In this case, remove the module from Device Manager by selecting its device name and press the* ***Remove*** *button. Then go through the driver installation process again.*

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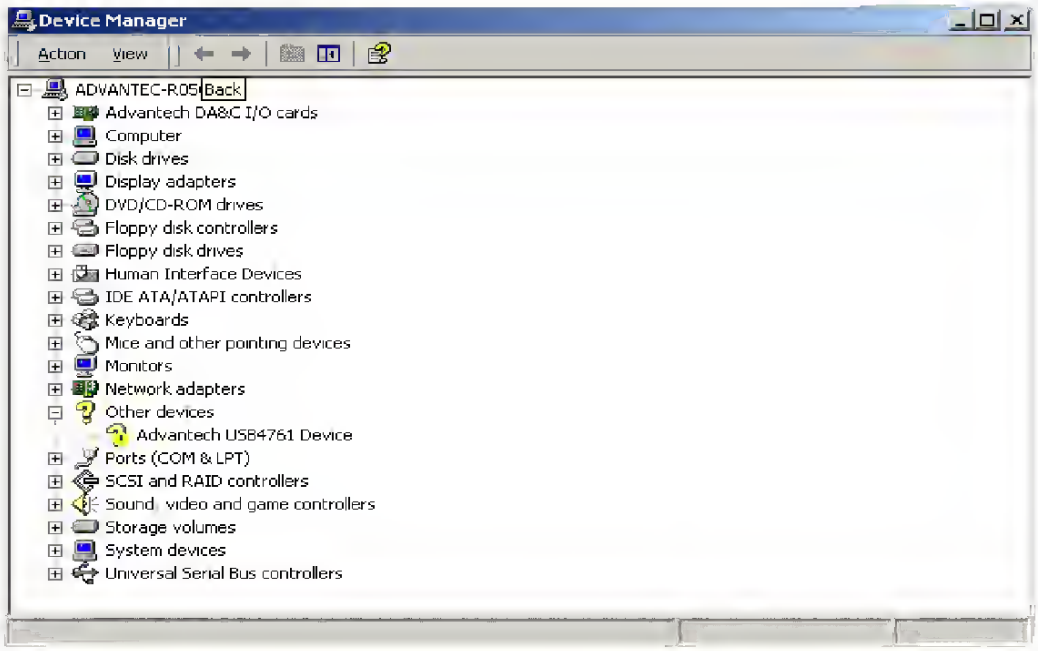

Figure 2.3: The (!) Indicates Improper Installation

After your module is properly installed with your system, you can now configure your device using the *Advantech Device Manager* that has itself already been installed on your system during driver setup. A complete device installation procedure should include *device setup*, *configuration* and *testing*. The following sections will guide you through the Setup, Configuration and Testing of your device.

2.4 Device Setup & Configuration

Advantech Device Manager is a utility that allows you to set up, configure and test your devices, and later stores your settings in the system registry. These settings will be used when you call the APIs of Advantech 32-bit DLL drivers.

2.4.1 Setting Up the Device

Step 1: To complete the device setup and configuration procedures, you must first install the device along with its driver. (Please refer to the previous section of Chapter 2 for detailed installation instructions).

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Step2: You can view the device(s) already installed on your system (if any) in the Installed Devices list box. If you haven't installed any devices, you might see a blank list.

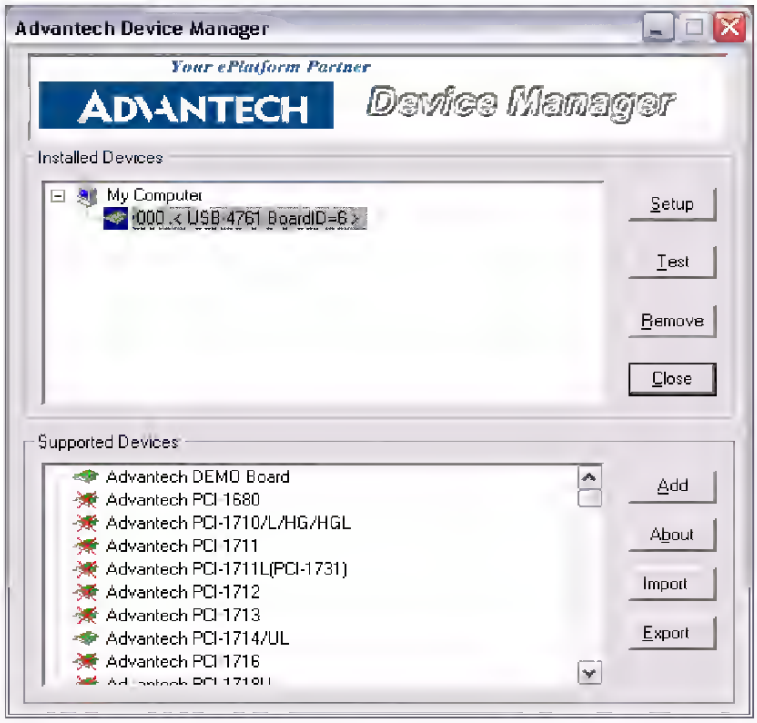

Figure 2.4: Device Manager Dialog Box

Note: If you have properly installed the device driver but still can't find it in Advantech Device Manager, please close the Advantech Device Manager and restart it.

2.4.2 Configuring the Device

Step 3: Click "***Setup***" button and you will see the "*Device Setting* "dialog box as follow. On the *Device Setting* dialog box, you can set the DI interrupt trigger edge and the power-on DO values.

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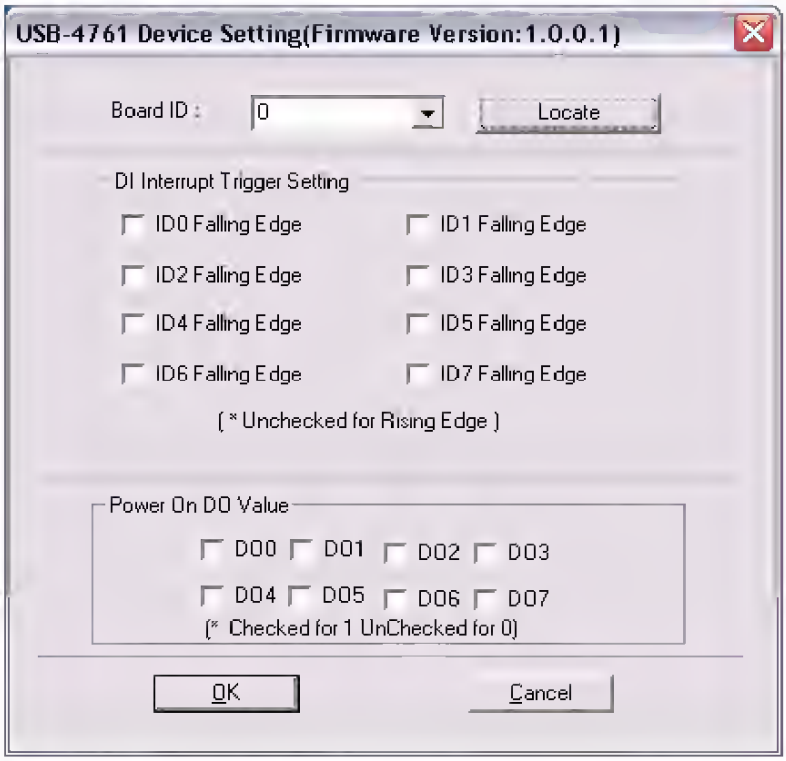

Figure 2.5: The Device Setting Dialog Box

Note: *Please refer to the software manual* ***Start/Programs/Advantech Automation/Advantech Device Manager/Device Driver's Manual*** *for the firmware download utility guidance and further information.*

2.5 Device Testing

Following the *Setup* and *Configuration* procedures to the last step described in the previous section, you can now proceed to test the device by clicking the ***Test*** Button in the *I/O Device Installation* dialog window. In the *Device Test* dialog window, you are free to test the functions of USB-4761 on Digital input and Digital output tabs.

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2.5.1 Testing Digital Input Function

Click the *Digital Input* tab to show the *Digital Input* test panel as seen below. By the color of the LEDs, you can easily discern whether the status of each digital input channel is high or low.

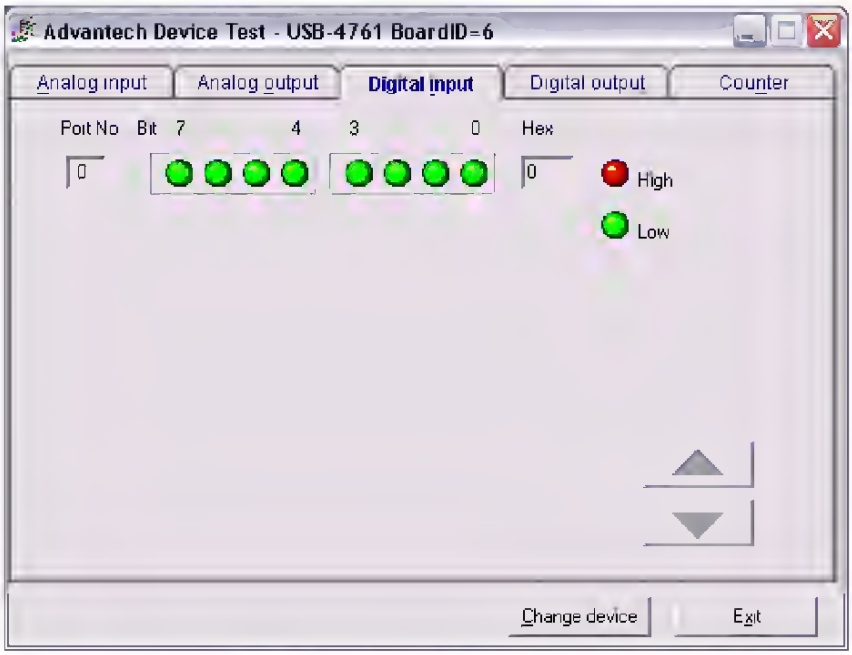

Figure 2.6: Digital Input Tab in Device Test Dialog

2.5.2 Testing Digital Output Function

Click the *Digital Output* tab to bring up the *Digital Output* test panel as shown below. By pressing the buttons on each tab, you can easily set each digital output channel as *high* or *low* for the corresponding port

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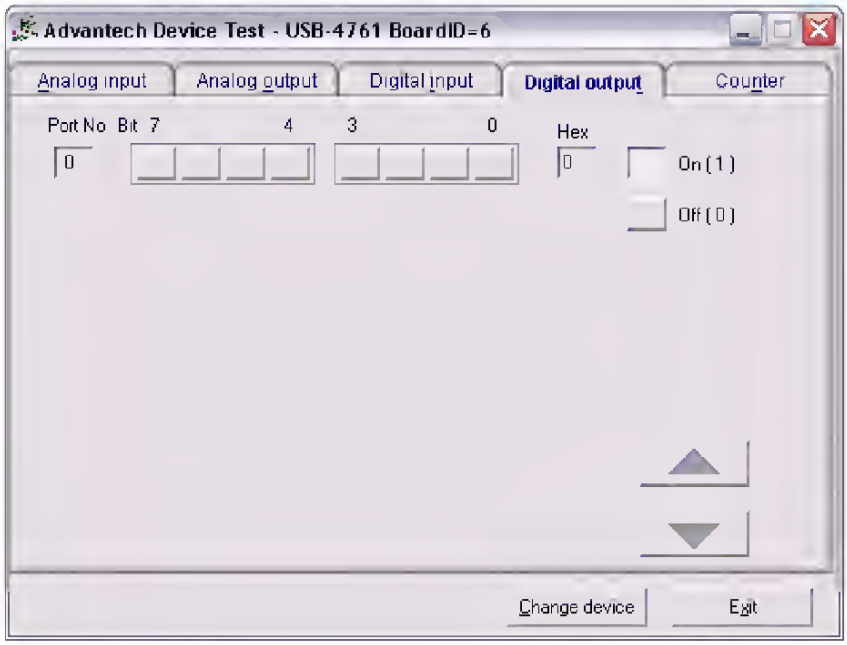

Figure 2.7: Digital Output Tab in Device Test Dialog

Only after your module device is properly set up, configured and tested, can the device installation procedure be considered complete. After the device installation procedure is completed, you can safely proceed to the next chapter, *Signal Connections*.

2.6 Hardware Uninstallation

Though the Advantech USB modules are hot swappable, we still recommend you to follow the hardware un-installation procedure to avoid any unpredictable damages to your device or your system.

Step1: Close the applications of the USB module (ex. Advantech Device Manager).

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Step2: Right click the "Unplug or Eject Hardware" icon on your task bar.

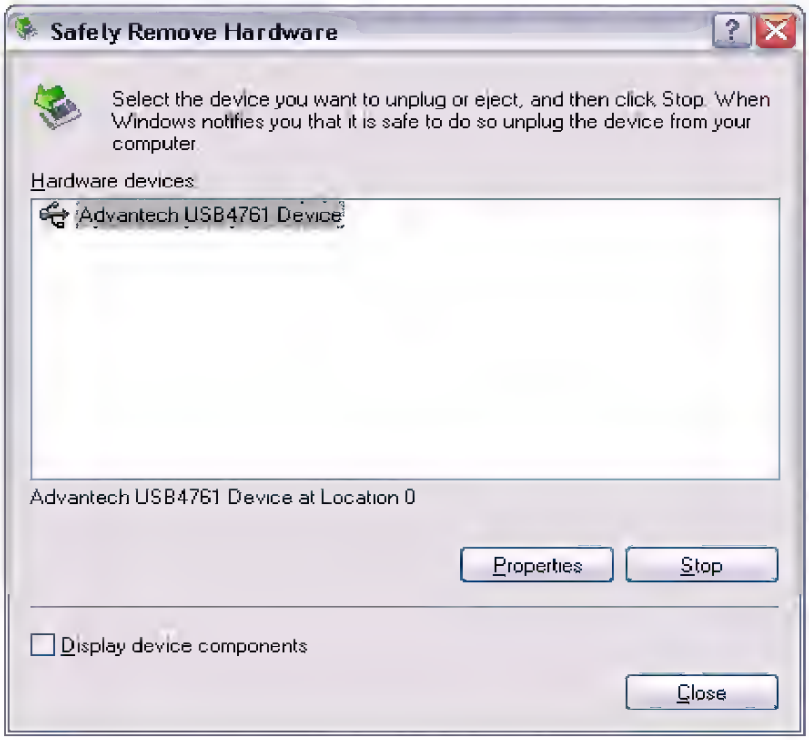
Safely Remove Hardware
Select the device you want to unplug or eject, and then click Stop. When Windows notifies you that it is safe to do so unplug the device from your computer.
Hardware devices:
Advantech USB4761 Device
Advantech USB4761 Device at Location 0
Properties
Stop
Display device components
Close

Figure 2.8: Unplug or Eject Hardware Dialog

Step3: Select "Advantech USB4711 Device" and press "Stop" Button.

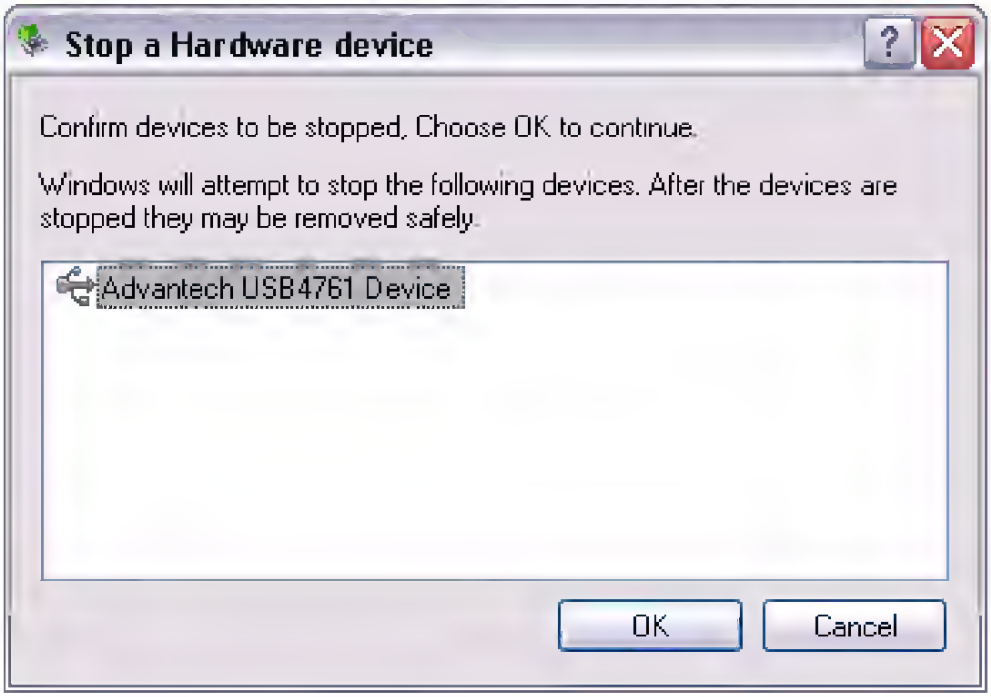
Stop a Hardware device
Confirm devices to be stopped, Choose OK to continue.
Windows will attempt to stop the following devices. After the devices are stopped they may be removed safely.
Advantech USB4761 Device
OK
Cancel

Figure 2.9: Stop a Hardware device dialog box

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Step4: Unplug your USB device from the USB port.

Note: *Please make sure that you have closed the application programs before unplugging the USB device, otherwise some unexpected system errors or damages may happen.*

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CHAPTER 3

Signal Connections

This chapter provides useful information on how to connect input and output signals to the USB-4761 via the I/O connectors..

Sections include:

- Overview
- I/O Connectors
- Field Wiring Considerations

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Chapter 3 Signal Connections

3.1 Overview

Maintaining good signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices.

3.2 I/O Connectors

USB-4761 is equipped with plug-in screw-terminal connectors that facilitate connection to the module without terminal boards or cables.

3.2.1 Pin Assignment

Figure 3.1 on next page shows the pin assignments for the five 10-pin I/O connectors on USB-4761.

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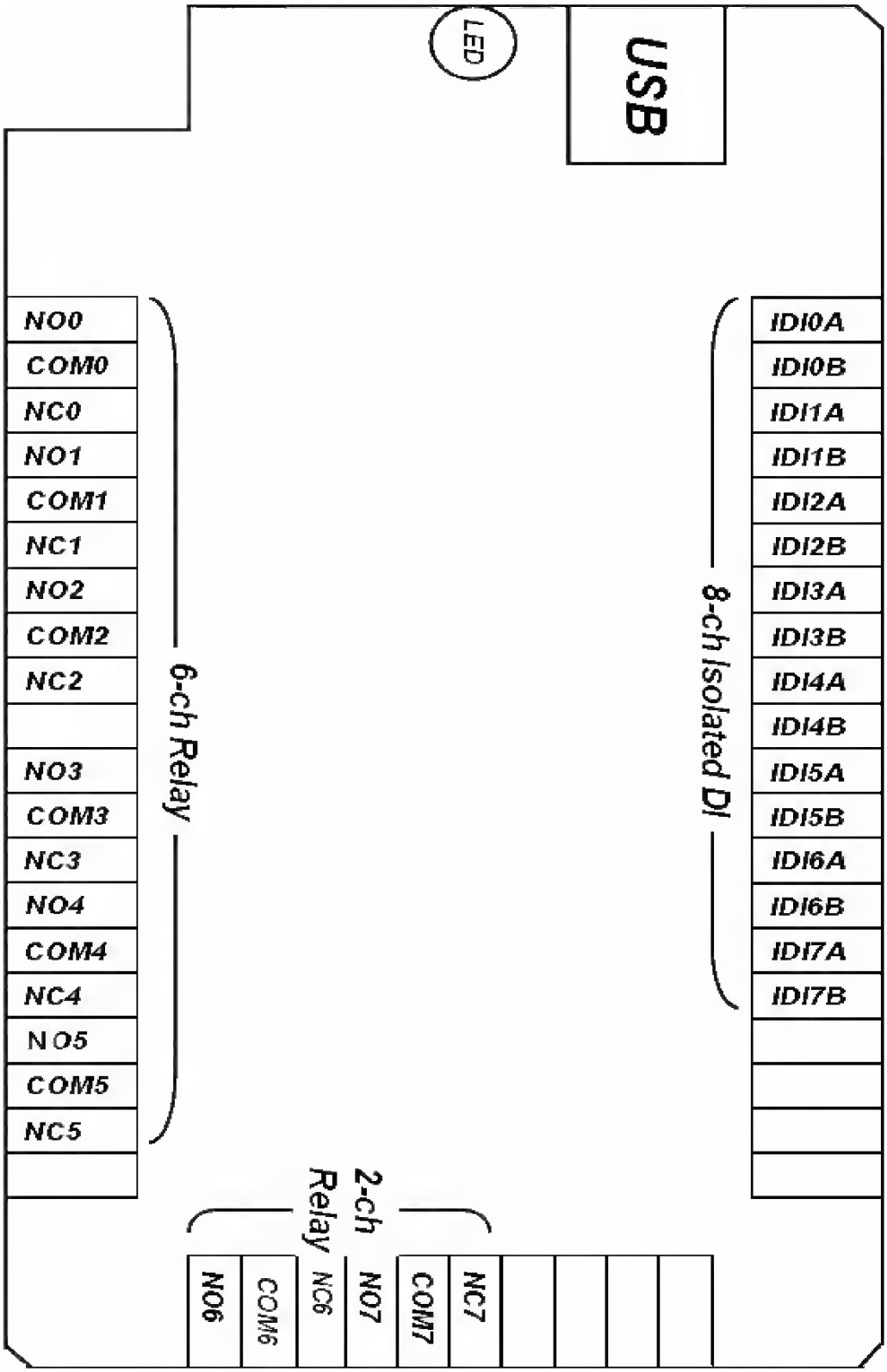

Figure 3.1: I/O Connector Pin Assignment

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3.2.2 I/O Connector Signal Description

Table 3.1: I/O Connector Signal Description	
Signal Name	**Description**
NO<0~7>	Normally Open pin of relay output
COM<0~7>	Common pin of relay output
NC<0~7>	Normally Close pin of relay output
IDInA <n=0~7>	Isolated digital input A
IDInB <n=0~7>	Isolated digital input B

3.2.3 LED Indicator Status Description

The USB Module is equipped with a LED indicator to show the current status of the device. When you plug the USB device into the USB port, the LED indicator will blink five times and then stay lit to indicate that it is on. Please refer to the following table for detailed LED indicator status information.

Table 3.2: LED Indicator Status Description	
LED Status	**Description**
ON	Device ready for work
Off	Device not ready to work
Slow Blinking (5 times)	Device Initialization
Fast Blinking (Depends on data transfer speed).	Device working

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3.3 Isolated Digital Input Connections

3.3.1 Single-ended Channel Connections

USB-4761 has 8 isolated digital input channels. Each of isolated digital input channel accepts 10~30 V_{DC} voltage inputs, and accept bi-directional input. It means that you can apply positive or negative voltage to an isolated input pin (Vin). The figure below shows how to connect an external input source to one of the card's isolated input channels.

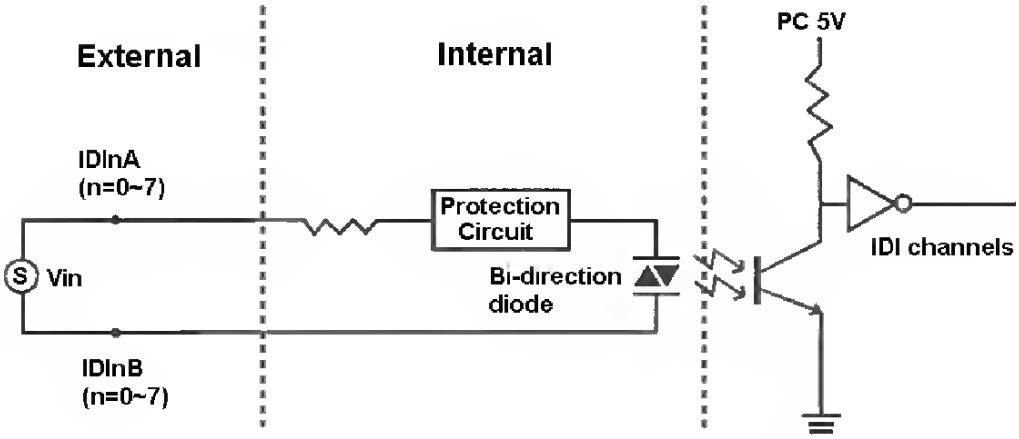

Figure 3.2: Isolated Digital Input Connections

3.4 Relay Connections

After power on, the initial relay output status is shown as below:

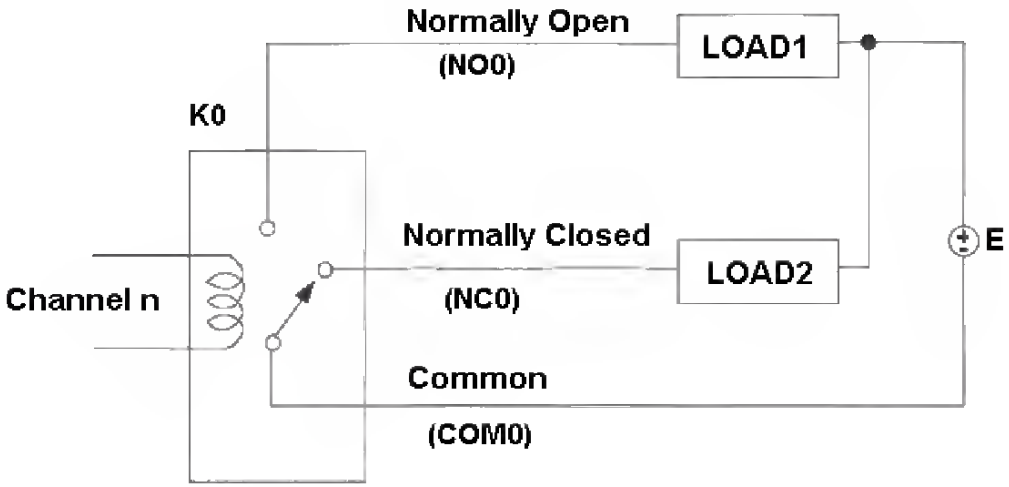

Figure 3.3: Relay Output Channel Connections

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3.5 Field Wiring Considerations

- When you use USB-4761 to acquire data from outside, noises in the environment might significantly affect the accuracy of your measurements if due cautions are not taken. The following measures will be helpful to reduce possible interference running signal wires between signal sources and the USB-4761.
- The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, since they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, since it can significantly affect a data acquisition system.
- If the cable travels through an area with significant electromagnetic interference, you should adopt individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.
- Avoid running the signal cables through any conduit that might have power lines in it.
- If you have to place your signal cable parallel to a power line that has a high voltage or high current running through it, try to keep a safe distance between them. Or place the signal cable in a right angle to the power line to minimize the undesirable effect.

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APPENDIX A

Specifications

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Appendix A Specifications

A.1 Isolated Digital Input

Channels	8	
Optical Isolation	2,500 VDC	
Opto-isolator response time	25us	
Input Voltage	VIH (max.)	30VDC
	VIH (min.)	5VDC
	VIL (max,)	2VDC
Input current	5VDC	1.2mA
	12VDC	3.3mA
	24VDC	6.9mA
	30VDC	8.7mA

A.2 Relay Output

Channels	8	
Relay Type	Form C	
Rating (Resistive)	30 VDC@1 A 110 VAC@0.3 A 120 VAC@0.5 A 240 VAC@0.25 A	
Max. Switching Power	62.5 VA, 60 W	
Max. Switching Voltage	220 VDC,250 VAC	
Max. Switching Current	5 A	
Breakdown Voltage	1500 V	
Operate time	5 ms max.	
Release time	4 ms max.	
Insulation Resistance	$1X10^9$. (at 500 VDC)	
Life Expectancy	Mechanical	$1X10^8$ operations (typical)
	Electrical	12 V@10 mA: $5X10^7$ operations (typical) 6 V@100 mA: $1X10^7$ operations (typical) 60 V@500 mA: $5X10^5$ operations (typical) 30 V@1000 mA: $1X10^6$ operations (typical) 30 V@2000 mA: $2X10^5$ operations (typical)

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A.3 General

I/O Connector Type	Removable 10-pin screw terminal x 5	
Dimensions	132 X 80 X 32 mm (5.2" X 3.2" X 1.3")	
Power Consumption	60mA@+5V typical, 400mA@+5V max.	
Temperature	Operation	0~60 (32~140) (refer to IEC 68-2-1, 2)
	Storage	-20~70 (-4~158)
Relative Humidity	5%~95% RH non-condensing (refer to IEC 68-2-1, 2)	

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APPENDIX B

Function Block

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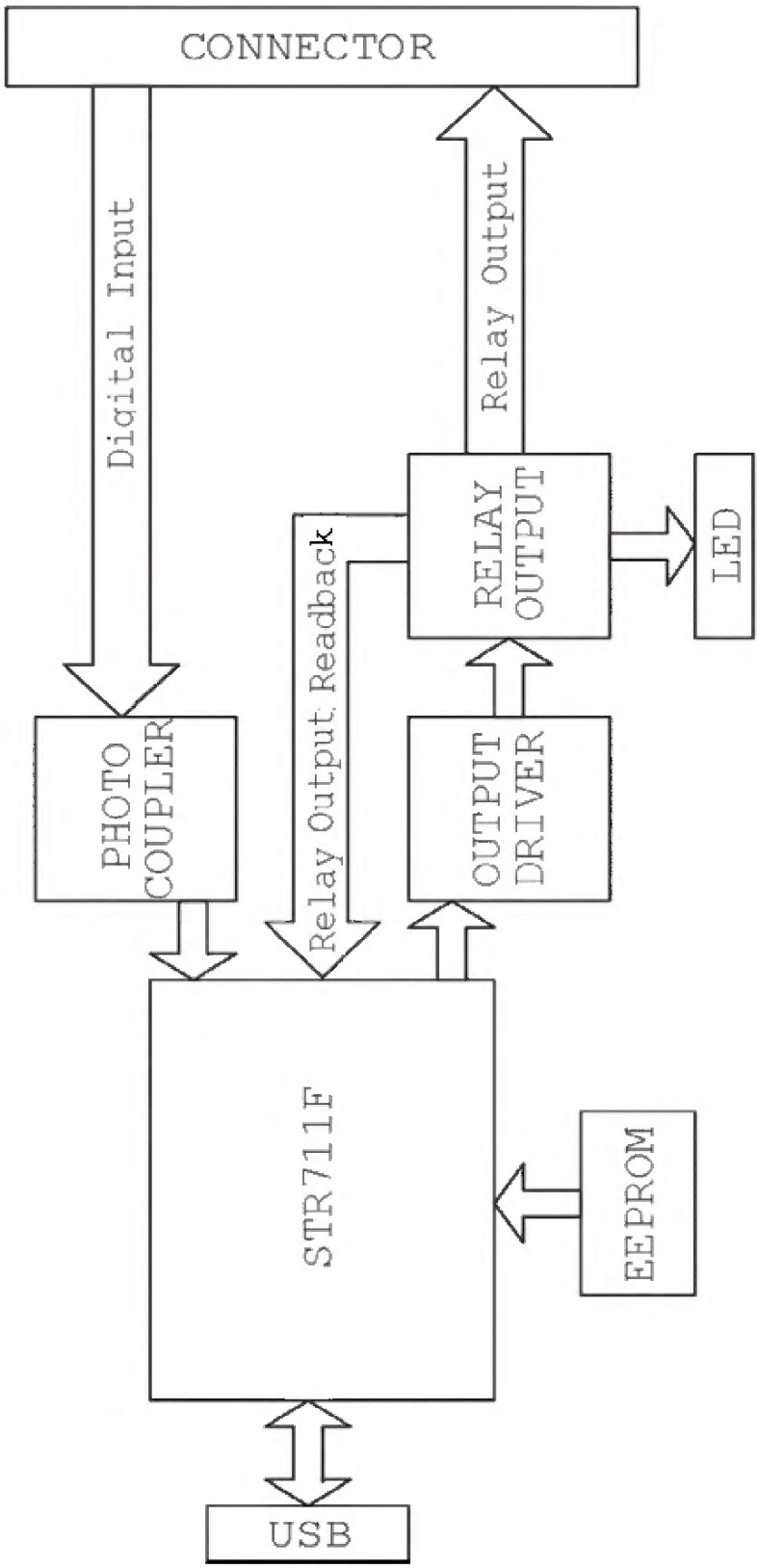
Appendix B Function Block



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